Progress on Incorporating Climate Change into Management of California's Water Resources

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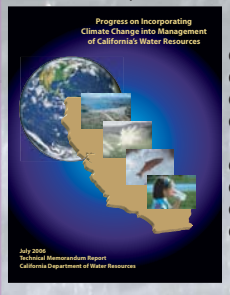
Motivation

- Gov. Arnold Schwarzenegger issued Executive Order S-3-05 on June 1, 2005
- Establishes green house gas emission reduction targets
- Requires reports every two years on climate change impacts to five areas, including water resources
- Formed Climate Action Team to oversee reports
- http://climatechange.ca.gov

DWR Climate Change Report

- Prepared by DWR-Reclamation Climate Change Work Team
- Technical chapters were peer reviewed
- http://baydeltaoffice.water.ca.gov/climatechange.cfm
- For hard copies contact DWR Publications at 916-653-1097 or e-mail imr-publications@water.ca.gov



Climate Change Scenarios

- 4 scenarios were selected by the Climate Action Team
- 2 models x 2 green house gas emissions scenarios
- All scenarios show warming
- No consistent trend in precipitation change

Air Temperature and Precipitation Changes for 4 Climate Change Sceanrios

Scenario/ Model	A2	B1
GFDL	↑ ↓	↑ ↓
PCM	↑ ↓	↑ ↑

Acknowledgements

Contributors to this report include the following DWR staff:
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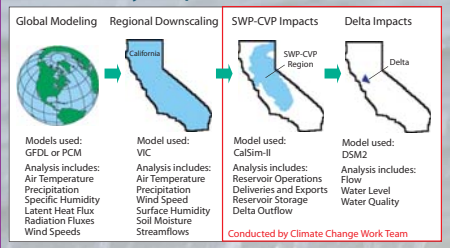
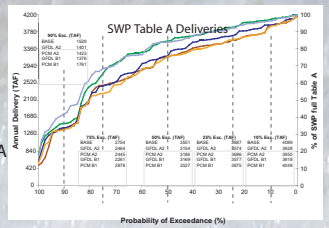
Preliminary Impacts Assessment Methodology

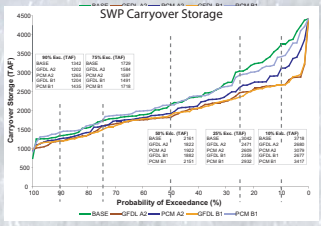


- Use existing models
- 2050 runoff projections
- 2020 land use estimates
  - Modify historical inflows to reservoirs to reflect climate change
- Use current operating rules
- No operations changes for sea level rise
- All results are preliminary

State Water Project and Central Valley Project Impacts

- Current operating rules lead to shortages in CVP North-of-Delta reservoirs during droughts; operations changes may be necessary
- Changes in SWP Table A deliveries ranged from +1% for the wet scenario to -10% for the drier scenarios
- Increased winter runoff & lower Table A allocations lead to higher Article 21 deliveries for the 3 drier scenarios; for the wet sceanrio higher Table A allocations resulted in slightly lower Article 21 deliveries
- Changes in CVP South-of-Delta deliveries ranged from +2.5% for the wet scenario to -10% for the drier ones
- For both SWP and CVP, carryover storage was reduced for the drier scenarios & increased for the wet one
- Changes in stream temperature and power generation were also examined
- Sea level rise was not considered





Sacramento-San Joaquin Delta Impacts

- Base case and four climate change scenarios
  - present sea level
  - one-foot sea level rise (SLR) with no change in operations from present sea level
- Water quality standard compliance at municipal and industrial intakes
  - 100% compliance at SWP and CVP for all scenarios
  - Operations changes maintain compliance for present sea level scenarios
  - SLR with no changes to operations ⇨~8% increase in violations at Rock Slough

Compliance with 250 mg/l Standard at Old River at Rock Slough

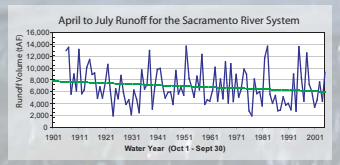
Scenario	BASE	1ft SLR	GFDL A2	PCM A2	GFDL B1	PCM B1
Present sea level	97.2%	-	98.0%	98.0%	98.2%	97.4%
1-ft sea level rise	97.2%	89.9%	89.6%	90.3%	90.1%	90.9%

- Chloride mass loadings at municipal and industrial intakes
  - Decreased for climate change at present sea level scenarios due to lower exports
  - Increased for 1-ft sea level rise scenarios due to increased salt intrusion
- Sea level rise could increase the potential to overtop Delta levees
- Future work will look at operations changes to reduce effects of sea level rise

Flood Management Impacts

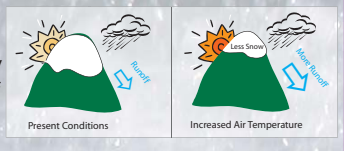
Field data for California indicate

- Increasing air temperatures
- Increasing precipitation in North decreasing precipitation in South
- Interannual variability in precipitation is increasing
- More runoff in winter (Oct-Mar) Less runoff in spring/summer(Apr-Jul)
- Flood peaks increasing in mean and variance



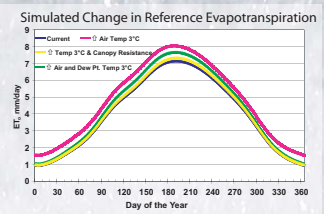
Future climate change

- Projections are for long-term averages
- Actual weather events may vary greatly
- Changes in variability and frequency of extreme events are important and are not well represented in climate models



Evapotranspiration Impacts

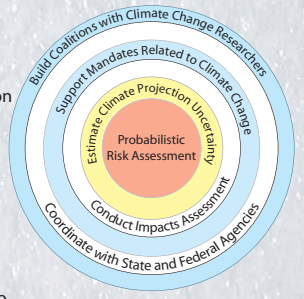
- Evapotranpiration (ET) has 2 processes
  - -Evaporation from soil, water & plants
  - -Transpiration of water from plants to air
- Climate change could affect both processes
- 3°C increase in air temp increases reference ET by 3%-6% which is a large volume of water over the entire state
- Higher water demands due to climate change could be offset by improved water use efficiency



- SIMETAW model could be used to study ET changes due to climate change

Future Directions

- Provide information that is useful to water resources managers
- Interact with climate change researchers
- Regularly update climate change information
- Develop needed tools and methods e.g. a way to represent sea level rise in operations studies
- Develop representation of climate change effects on consumptive use of water due to changes in crop evapotranspiration
- Study more climate change scenarios
- Extend impacts analysis to risk assessment by associating likelihoods with each scenario



Climate Change Work Team Goals

Additional Information

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- http://baydeltaoffice.water.ca.gov/climatechange.cfm